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FCC Mail Room

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Marlene H. Dortch, Office of the Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington DC 20554

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Comments submitted for GN Docket No. 09-51

In its announcement of April 8, 2009, the Federal Communications Commission (FCC) stated, in paragraph 5 of the INTRODUCTION, that:

"Our goal must be for every American citizen and every American business to have access to robust broadband services."

This is a fine goal, except for one thing: as things stand now, it will come at the price of the destruction of the health of many American citizens.

Therefore I think this goal should be restated as follows: "Our goal must be for every American citizen and every American business to have access to robust broadband services, to the extent that this can be achieved without adversely affecting the health of American citizens."

At present, the FCC is the single government agency most strongly responsible for the current widespread ill health of the American public. This is because the radio-frequency transmitters that it licenses are a source of ill health, both directly and indirectly, to a substantial population of American citizens. I know this because I have been contacted by some of these citizens, and I have visited their homes and learned first-hand what kind of health problems they have. In many cases these problems are, in my professional judgment, caused by proximity to a radio-frequency transmitter that is licensed by, and operating with the approval of, and in compliance with the regulations of, the FCC. In some cases the electromagnetic field in the air around the transmitter is the cause of ill health, while in other cases the electrical grounding of the transmitter to the earth seems to be the source of the health problem.

In the latter situation, there is an opportunity for radio-frequency signals to reach the earth, which gives them an opportunity to gain access to the electric power system. Because of design decisions made in the 1920s by the electric companies in the USA, the earth was utilized as an electrical conductor connected in parallel with the neutral wire of a three-phase 4-wire distribution system, which means that any high-frequency signal that may reach the earth, such as through an electrical ground connection, can gain access to the electrical power system, which gives it a route into homes and businesses that use electricity. When radio-frequency signals are present on electrical wiring in buildings, they pose a very serious hazard to health that can make that building a very unhealthful place for a human being to spend time.

The FCC has tried to make its transmitters safe, but it has been unable to accomplish this in part because the fundamental scientific research that is needed as a foundation for truly protective safety standards simply has not been done. Therefore, the health protection demanded by the American people cannot be provided at present, because there does not exist a basis for it within current scientific research. Most certainly, it cannot be provided by compliance with current voluntary consensus standards.

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New scientific research is needed, if the health of the American people is to be properly protected. For this reason, the effort to develop a plan for nationwide broadband services should be placed on “hold” while the FCC communicates to Congress that it needs to authorize research into the health effects of radio-frequency radiation and fields that goes beyond what has been done in the past.

I earned an A.B. degree in mathematics in 1959 from Randolph-Macon Woman’s College [now renamed Randolph College], Lynchburg, VA; and the M.S. and Ph.D. degrees in physics from the University of Virginia in Charlottesville, VA, in 1962 and 1965, respectively.

I have had a career as an industrial hygienist, in which I was charged with protecting the health of occupationally exposed individuals from various hazardous agents in their working environment. For over 20 years I was a Certified Industrial Hygienist—certified by the American Board of Industrial Hygiene (Lansing, MI) in the comprehensive practice of industrial hygiene—which entitled me to place the letters “C.I.H.” after my name. When I retired, I let this certification lapse, so I am not now certified.

During the 1980s I began to doubt that the U.S. population was being adequately protected against the hazards to health posed by radio-frequency radiation, and therefore I commenced study of the non-ionizing electromagnetic field, with a view to correcting the errors that I believed had to be present in the various voluntary consensus standards in existence at that time.

By the late 1990s I felt I had achieved sufficient understanding of the non-ionizing electromagnetic field to begin communicating my findings to fellow scientists. In the context of a health hazard associated with the use of wireless telephones, I made the point that electromagnetic fields are capable of transmitting not only energy, but also momentum. Because the magnitude of the momentum-transmission effect is very much smaller than the magnitude of the energy-transmission effect, it is usually disregarded, and many electrical engineers are unaware of it, having learned only about the energy-transmitting capabilities of the electromagnetic field. In this context I authored Chapter 4 in the book **Wireless Phones and Health II: State of the Science** [Reference 1].

During the 21st century I continued to communicate my findings to my scientific peers by presenting papers at the March meeting of the American Physical Society in 2003, 2004, 2005 and 2006. Abstracts of these papers have been published in the March issue of volumes 48-51 of the **Bulletin of the American Physical Society**. Because I am unable to provide complete citations to these abstracts at the time I am writing this, I am providing copies of these abstracts with this submission, and I am taking the opportunity to correct the few errors that are present in them. These are listed in the References as numbers 2 through 7.

I shall briefly summarize here. As I point out in Reference 7, it was known to physicists by 1910 that matter can interact with light (which is electromagnetic radiation that happens to be visible to the human eye) in three basic ways: the matter can absorb energy, and/or linear momentum, and/or angular momentum. This is true for all frequencies, at least in principle.

As discussed in Reference 4, the electrical engineering profession became the “custodian” of ANSI C95 and because most electrical engineers are ignorant of the momentum transfer capabilities of the electromagnetic field, all their attention became focused on the energy absorption interaction. So, for the past half-century, the voluntary consensus standards have tried to protect human health by paying attention only to the thermal effects associated with energy absorption. This is an impossible task, because cancer

and the chronic illnesses that are devastating our society today are caused by the nonthermal health effects (associated with momentum transmission) that have been completely ignored by those who claim to be protecting our health: electrical engineers acting through the IEEE and its sponsorship of ANSI C95. [See Reference 1 for a discussion of the relation between nonthermal health effects and cancer.]

Following the example set by the electrical engineers with ANSI C95, all the attempts to establish other voluntary consensus standards more protective of human health than ANSI C95 have focused on the energy transfer effects, because the people involved in those efforts were no more knowledgeable about the electromagnetic field than the electrical engineers were.

Human health cannot be protected against the harmful effects of exposure to the electromagnetic field until research is done on the momentum-transmission effects of the non-ionizing electromagnetic field. No such research has been done to date. This is why it is my position that all efforts to expose the U.S. population even more strongly to radio-frequency electromagnetic fields than it is at present should be brought to an abrupt halt while steps are taken to address the phenomena crucial to health by research.

The U.S. population was much better protected against the harmful effects of exposure to non-ionizing electromagnetic radiation half a century ago than it is today. At that time, electrical engineers knew that the “near field” of an antenna was hazardous to human health. They did not understand *why* this was true, but they did recognize that it *was* true, and as a result, they very sensibly took care to design equipment so as to keep human beings out of the “near field”. They had an exposure standard applicable to the “far field” that protected against thermal health effects. They were missing protection against the non-thermal hazards of a “far field” exposure: the absorption of linear and angular momentum.

Of the two, I judge that the angular momentum is the more hazardous; this for the far field is controlled by the polarization of the radiation. Polarization of an electromagnetic wave may be linear (plane-polarized), or circular, or elliptical. Plane-polarized radiation has zero angular momentum, so poses the least hazard with respect to angular momentum. Circularly and elliptically polarized radiation possess non-zero angular momentum, and therefore do pose a potential angular momentum hazard, with circularly polarized radiation being the more hazardous, when all other factors are equal.

The FCC currently requires that FM radio stations transmit a circularly polarized signal. In doing so, the FCC mandates the exposure of the population of the USA to potentially hazardous radiofrequency radiation. Does this pose a serious health hazard to the U.S. population? I don’t know, because the research that could answer that question has not been carried out.

The Notice of Intent to which this is a response can be interpreted as a statement of intent to take action that will seriously worsen the health of the American people. If the FCC refuses to inform the Congress that it is unable to develop a plan to accomplish the desired objective of providing “robust broadband services” to all American citizens and businesses *safely*, in the absence of needed research into the momentum-transmitting effects of radio-frequency fields, then I will have to conclude that the FCC is functioning within the USA as a **terrorist organization** and should be reported as such to the Department of Homeland Security, and should be treated as such by that agency!

I would hate to take such action, but history teaches us that the ancient Romans were destroyed by lead poisoning, in part because thrifty Roman housewives used lead oxide to “sweeten” sour wine. We in the USA today seem to me to be doing something similar using radio-frequency (RF) fields: the pollution of our electric power lines by RF signals that produce harmful RF fields around the wires in our homes

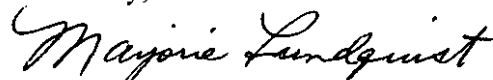
and offices, and the introduction of microwave frequencies into our environment for wireless phones, seem to me to be adversely affecting human reproduction, as evidenced by the growth of fertility clinics where people who cannot conceive naturally are going, in order to start a family using in vitro fertilization techniques.

I have visited dairy farms in Wisconsin where the cows sickened and died because of the presence of extremely small amounts of RF current on the earth. Based on experiments, cellular phone transmitter towers often are responsible for these extremely hazardous RF currents. One farmer knew that when one such transmitter was put out of operation after a thunderstorm, the health problems his cows had been experiencing vanished, and his milk production returned to normal. But when that transmitter resumed operation after the power outage, his cows again became ill and his milk production dropped.

The mammalian reproductive system is extremely sensitive to microwave exposure, whether the mammal is a dairy cow or a human being. Progress has a price. Many Americans do *not* want to pay the price of infertility and ill health, in order to gain the benefits that the FCC is determined to provide us!

If the FCC wants to behave responsibly in this matter, let it inform Congress that research is needed, in order to enable the FCC to do the task being asked of it in a *responsible* manner.

Sincerely,



Marjorie Lundquist, Ph.D.
Bioelectromagnetic Hygienist

Enc.: text of References 2 - 7

References

- [1] **Wireless Phones and Health II: State of the Science**, George L. Carlo, editor. Norwell, Mass: Kluwer Academic Publishers, 2000.
- [2] Marjorie Lundquist. The non-ionizing electromagnetic field: Derivation of valid biological exposure metrics from Maxwell's equations of electromagnetism. **Bulletin of the American Physical Society** 48 (March 2003).
- [3] Marjorie Lundquist. Chronic exposure to pulsed low-intensity microwaves is carcinogenic and tumorigenic. **Bulletin of the American Physical Society** 49 (March 2004).
- [4] Marjorie Lundquist. A half-century ago physicists missed a major public service opportunity, costing the human race widespread chronic illness and many deaths! **Bulletin of the American Physical Society** 50(2):620 (March 2005).
- [5] Marjorie Lundquist. Today's "safe" radiofrequency (RF) exposure limits DON'T protect human health near transmitters! **Bulletin of the American Physical Society** 50(2):1178 (March 2005).
- [6] Marjorie Lundquist. The challenge of characterizing an inefficient antenna field for health protection purposes. **Bulletin of the American Physical Society** 51 (March 2006).
- [7] Marjorie Lundquist. A surprising answer in the search for a comprehensive health protection exposure metric for radiofrequency (RF) fields. **Bulletin of the American Physical Society** 51 (March 2006)



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Session Y9 - Focus Session: Biomedical Physics and Physiology I.

ORAL session, Friday morning, March 07

Room 4 ABC, Austin Convention Center

[Y9.009] The non-ionizing electromagnetic field: Derivation of valid biological exposure metrics from Maxwell's equations of electromagnetism

Marjorie Lundquist (Bioelectromagnetic Hygiene Institute, Milwaukee, WI 53211-0831 USA)

Standards for protecting health from exposure to non-ionizing electromagnetic radiation treat the power density (magnitude of Poynting vector) as the biological exposure metric. For a static electric or magnetic field, the presumed metric is field strength.

Scientifically valid expressions for such exposure metrics have been derived theoretically [1]. Three regimes exist for which different expressions are obtained: high frequencies (where electric and magnetic fields are tightly coupled), low frequencies (where these fields are separable), and static fields (where time derivatives are zero). Unexpected results are obtained: * There are two exposure metrics: one for thermal, another for athermal effects. * In general, these two metrics are different. Only for a plane wave is the same metric (power density) valid for both effects. * Exposure metrics used today for static fields are invalid!

These findings also apply in the ionizing portion of the electromagnetic spectrum.

[1] Wireless Phones and Health II: State of the Science. G. Carlo, ed. NY: Kluwer Academic Publishers, 2000; Chapter 4.

■ **Part Y of program listing**



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Session W9 - Biomedical Physics II.

FOCUS session, Thursday afternoon, March 25

510B, Palais des Congres

[W9.007] Chronic exposure to pulsed low-intensity microwaves is carcinogenic and tumorigenic

Marjorie Lundquist (Bioelectromagnetic Hygiene Institute, Milwaukee, WI 53211-0831 USA)

To study health effects of lifetime exposure to low-intensity pulsed radiation >890 MHz, one controlled laboratory study of SPF* rats[1-3] and two of mice[4,5] were conducted, but only one[4] reported that its data showed an association between irradiation and cancer; reports of the other two studies minimized or denied such association. Critical review of these identified data evaluation errors; their correction enables a conclusion of microwave carcinogenicity from each study (the rat study also shows an association with endocrine-system primary malignancies and with a benign tumor of the adrenal medulla), enhancing the credibility of an epidemiological study[6] reporting a brain cancer risk for users of both analog and digital cellular phones. [1] J. Raloff. Science News 126(7):103(1984). [2] K. R. Foster and A. W. Guy. Sci Am 255(3):32-39(1986). [3] C.-K. Chou et al. Bioelectromagnetics 13:469-496(1992). [4] M. H. Repacholi et al. Radiat Res 147:631-640(1990)\SPF\ . [5] T. D. Utteridge et al. Radiat Res 158:357-364(2002)\non-SPF\ . [6] L. Hardell et al. Int J Oncol 22:399-407(2003). * SPF = specific-pathogen-free

■ **Part W of program listing**

*There is an error in Reference [4] above;
the correct year is 1997, not 1990.*

Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Sorting Category: 18.3 (T)

A half-century ago physicists missed a major public service opportunity, costing the human race widespread chronic illness and many deaths! MARJORIE LUNDQUIST, Bioelectromagnetic Hygiene Institute — Radar—pulsed microwave (MW) radiation—helped the Allies win World War II but health concerns soon arose. Alerted to a syndrome resembling *mild radiation poisoning*,¹ a worried M.D. surveyed radar-exposed workers, finding a high incidence of internal bleeding, 2 leukemia cases in 600 radar operators, 2 brain tumor cases in a 5-man MW research team and many complaints of headache. He sent his report² to the Pentagon in 1953. Alarmed Navy officers convened a meeting³ [mostly of electrical engineers (EEs)] to identify a safe level of MW exposure for servicemen. Biophysicist Herman Schwan attended, playing a major role in establishing 10 mW/cm² as a *thermally safe* MW exposure limit. The IEEE became sole sponsor of ANSI C95 [an early health standard for radiofrequency (RF) exposure] with *negative long-term consequences for human health!* I review RF health standards development since 1953, comparing what physicists might have done, had *they*—not EEs—had this responsibility! [See also my technical abstract.] ¹ N.H. Steneck, **The Microwave Debate**, Cambridge, MA: MIT Press, 1984; p. 33. ² J.T. McLaughlin, **A Study of Possible Health Hazards from Exposure to Microwave Radiation** (Hughes Aircraft, Culver City CA, Feb. 9, 1953). ³ **Biological Effects of Microwaves**, meeting minutes (Navy Dept. Conference, Naval Medical Research Institute, Bethesda MD, Apr. 29, 1953).

☒ Prefer Oral Session
☐ Prefer Poster Session

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Electronic form version 1.4

Abstract Submitted
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The American Physical Society

Scrtng Category: 10.13 (T)

Today's "safe" radiofrequency (RF) exposure limits DON'T protect human health near transmitters! MARJORIE LUNDQUIST¹, The Bioelectromagnetic Hygiene Institute — Maxwell's theory implies that electromagnetic (EM) radiation carries both energy and momentum. "The momentum may have both linear and angular contributions; angular momentum [AM] has a spin part associated with polarization and an orbital part associated with spatial distribution. Any interaction between radiation and matter is inevitably accompanied by an exchange of momentum. This often has mechanical consequences ..."² Voluntary consensus standards [ANSI C95; NCRP; INCIRP] protect human health from most *thermal* [energy transfer] effects, but no standards yet exist to protect health against *athermal* [momentum transfer] effects, though laboratory transfer of spin AM was reported by 1935³ and of orbital AM by 1992² for an optical vortex [tip of Poynting vector (PV) traces a helix about the beam axis]. In the *far field* of a dipole RF transmitter, radiation is linearly polarized (*minimal* spin AM) and locally approximated by a plane wave (*zero* orbital AM), but in the *near field* the orbital AM is *non-zero* [tip of PV traces an ellipse⁴ in air] implying an *athermal hazard* [e.g., brain tumors in cellular phone users] against which *no standard now in use anywhere in the world* protects!
² L. Allen *et al.* Phys. Rev. A **45**:8185-9(1992). ³ R.A. Beth, Phys. Rev. **48**:471(1935); **50**:115-25 (1936). ⁴ F. Landstorfer, Archiv für Elektronik und Übertragungstechnik **26**:189-96(1972) [in German].

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☒ Prefer Oral Session
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Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Sorting Category: 15.1 (T)

The challenge of characterizing an inefficient antenna field for health protection purposes MARJORIE LUNDQUIST, The Bioelectromagnetic Hygiene Institute — Growing evidence that the electromagnetic field around electrical wires is harmful to human health prompted a 1990s National Academy of Sciences study of power-frequency (50-60 Hz) fields; results for power-frequency fields were negative but data suggested that fields from *transients* may be hazardous.¹ Transients represent high frequencies that can reach into the radiofrequency (RF) range. What instrument can be used to measure an RF field around electric wires carrying RF current? Such an RF field is that of an *inefficient antenna*, which lacks the pure far-field region characteristic of an *efficient antenna field* for which standard RF measuring instruments are calibrated, making it impossible to obtain a properly calibrated measurement with such instruments. The *magnetic induction current* dB/dt is explored as an alternative way to characterize the *inefficient antenna RF field* sheathing electric wires carrying RF due to *poor power quality* (e.g., switching transients) or to utility use of *power line carrier*² or of FCC-approved *broadband on power lines*. ¹National Research Council, **Possible Health Effects of Exposure to Residential Electric and Magnetic Fields**, Washington, DC: National Academy Press, 1997. ²M. Vignati & L. Giuliani, *Environ. Health Perspect.* **105**(Suppl 6):1565-1568(1997).

☐ Prefer Oral Session
☒ Prefer Poster Session

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Date submitted: 30 Nov 2005

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There is an error in Reference 2 above;
the correct page numbers are 1569-1573,
not 1565-1568.

Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Sorting Category: 23.8.6 (T)

A surprising answer in the search for a comprehensive health protection exposure metric for radiofrequency (RF) fields MARJORIE LUNDQUIST¹, The Bioelectromagnetic Hygiene Institute — Matter can interact with light in 3 different ways (known by 1910): by absorption of energy [*thermal* hazard] or by absorption of linear momentum (radiation pressure) or of angular momentum (torque) or of both [*nonthermal* hazards].^{1,2} The same is true for RF fields; indeed, microwave wattmeters may operate on a momentum absorption principle.^{3,4} But most RF health protection standards today are based solely on *thermal* effects, ignoring nonthermal effects. Formal expressions for scientifically valid exposure metrics will be presented. It will be shown that nonthermal effects depend on field frequency, polarization and spatial configuration as well as on field strength, so a *general* metric valid for *all* fields may not exist. But with some approximations, the *magnetic induction current* may constitute an adequate *practical* exposure metric for RF fields. ¹M. Lundquist, BAPS 50(1):620(2005). ²M. Lundquist, BAPS 50(1):1178(2005). ³A. L. Cullen, Proc. IEE 99Pt4(2):100-110(Apr 1952). ⁴A. L. Cullen & I. M. Stephenson, Proc. IEE 99Pt4(4):294-301(Dec 1952).

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☒ Prefer Oral Session
☐ Prefer Poster Session

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Date submitted: 30 Nov 2005

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References 1 and 2 contain identical errors;
both ought to show issue number 2 of volume
50, not issue number 1.